Testing the New Booster BLM Integrators at a High Loss Location.

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Introduction

The new BLM integrator electronics integrate the charge produced in the beam loss monitor ionization chambers by making a continuous series of 80 microsecond integrations using a linear integrating op-amp with a 100pF capacitor. The integrating capacitor can be switched to a 500pF in the optional High Range mode.

The current style BLM integrators are a logarithmically scaled integrating amplifier that integrates continuously until it is reset. The log integrators were designed to handle the large dynamic range of signal amplitudes produced by accelerator beam losses.

The new BLM integrators have been designed to handle the large dynamic signal range also but will require special consideration in areas where beam losses are particularly high. One particular area in the Booster that experiences high losses, and hence large loss monitor signals, is at the collimators in Period 6. The loss monitor at this location is BLMS06.

The attached plots were recorded during the tests.

Observations

From the results of this test we see a couple things to note.

1. The scaling of the integrated data from the new electronics needs some work. The ACNET plot of the output of the Log Integrators show something a little larger than 2 rads/sec. The plots of the integrated results of the new electronics show outputs around 0.18 rads/sec. We will be working on this.
2. A 15K Ohm series resistor can be added to the signal feed through box along with a capacitor greater than 47000pF from signal to ground or with the integrator channel set into the High Range mode.

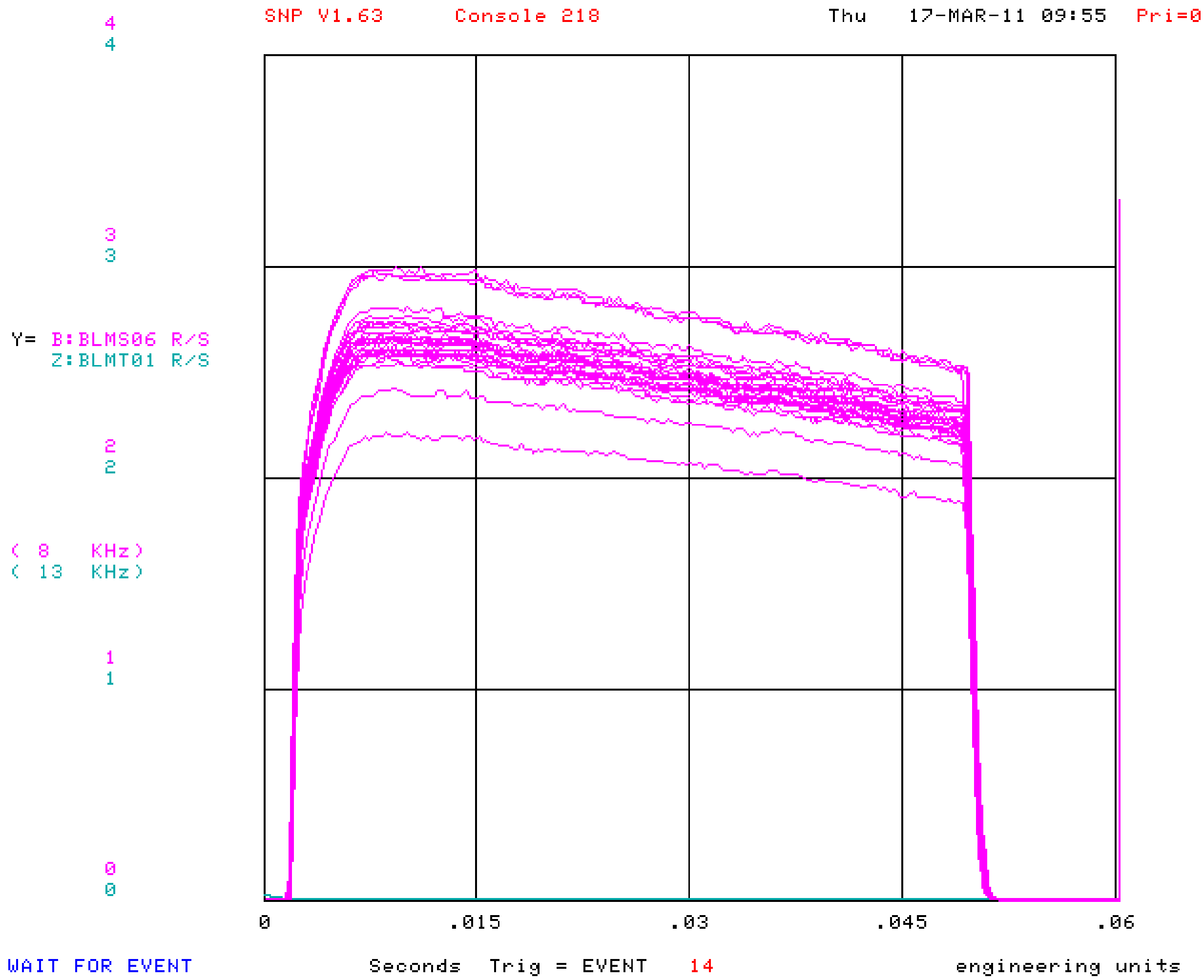
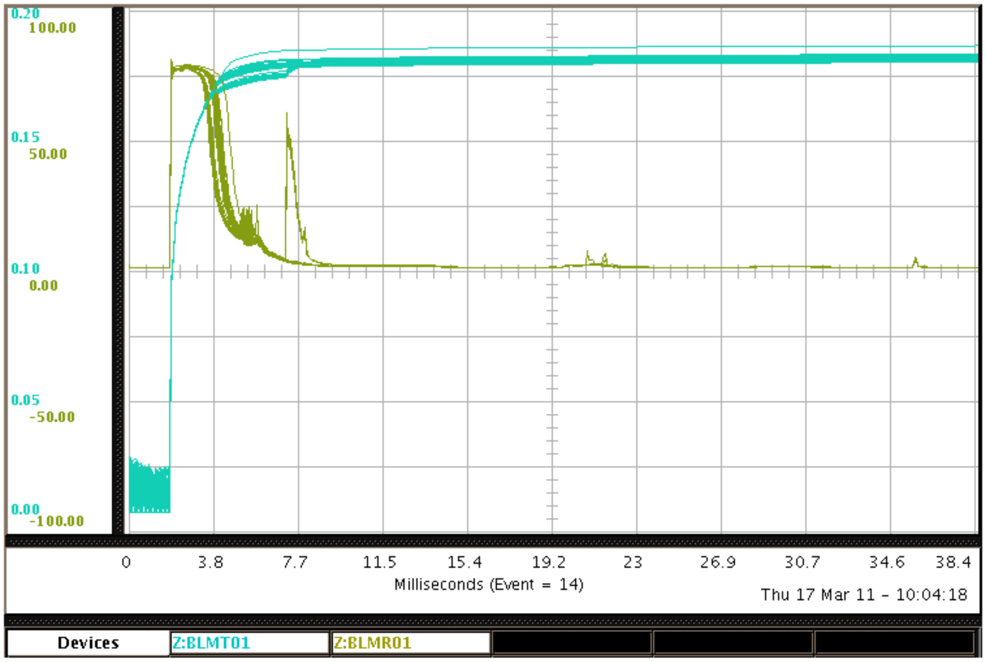


Figure 1 This is a snapshot plot of B:BLMS06 that was integrated using the standard Log-integrator.

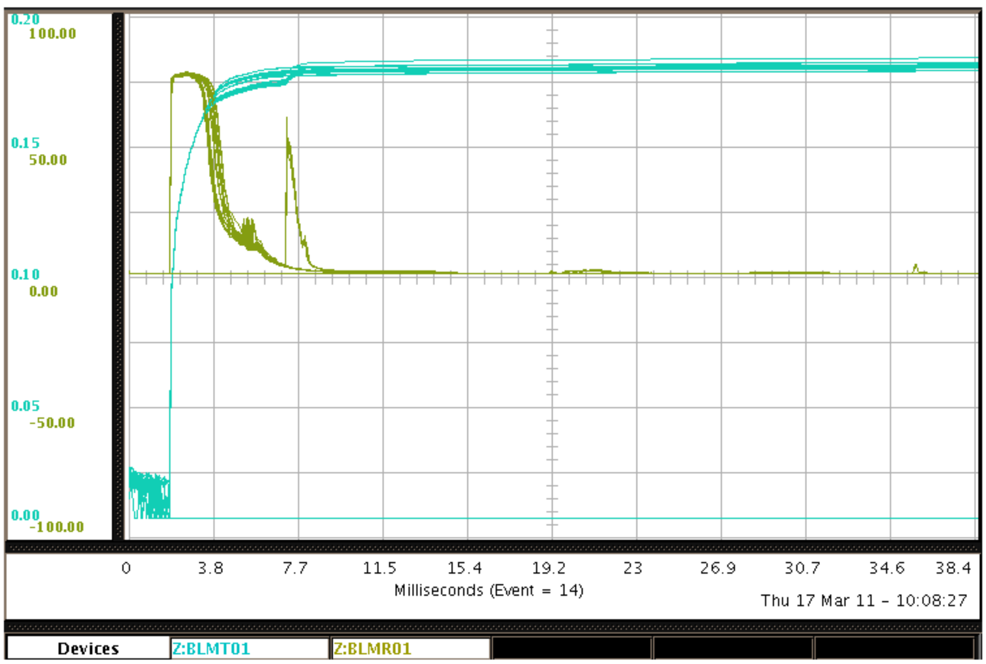


This is the BLMS06 loss monitor signal into the VME Integrator module in the default configuration.

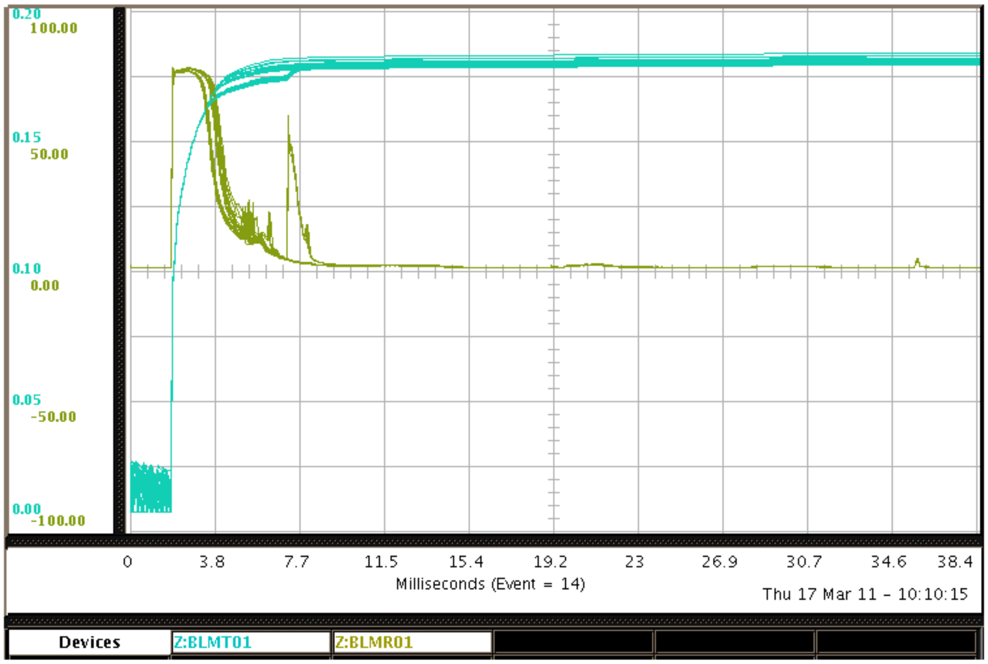
The VME front panel LED indicates that the channel is going into the overrange mode with this signal.

Z:BLMT01 (cyan) is the Log of the integrated (summed) result. The units on this trace are supposed to be rads/second, but we need to look into the scaling.

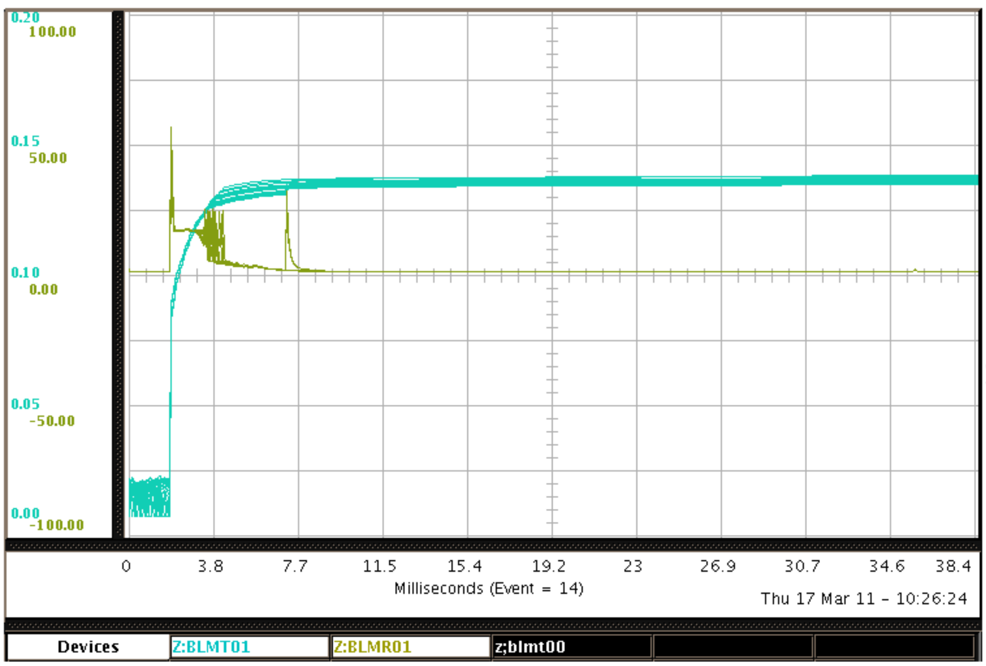
Z:BLMR01 (olive) is a plot of the 80 microsecond integration samples as read from the VME integraotr FIFO's. The units for the trace are in percent of full scale.



For this plot a 1k Ohm series resistor was applied to the BLM signal input cable. There was very little effect. Note the integrated value is approximately the same as before.



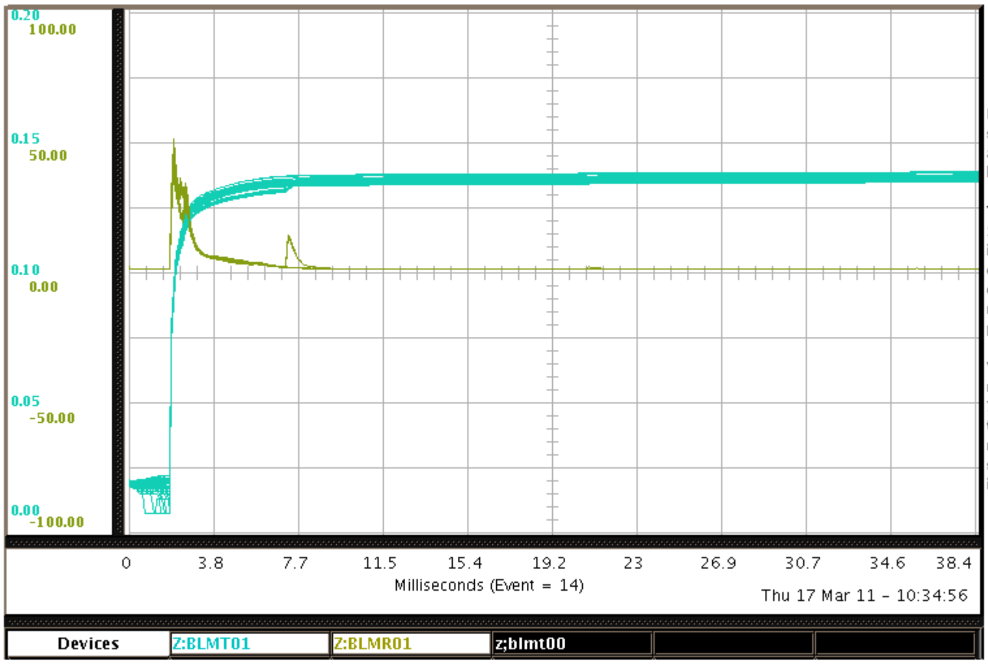
For this plot a 1000 pF capacitor was connected from the input signal to ground. This increased the cable capacitance, but it had little effect on the signal.



For this plot the VME module was put into the High Range mode. This is done by inserting a jumper across particular pins of J74. In this mode the integration capacitance is increased from 100 pF to 500 pF.

The value of the 80 microsecond integrations (BLMR01) have been reduced from 78% to around 16%. This is the factor of 5 you would expect.

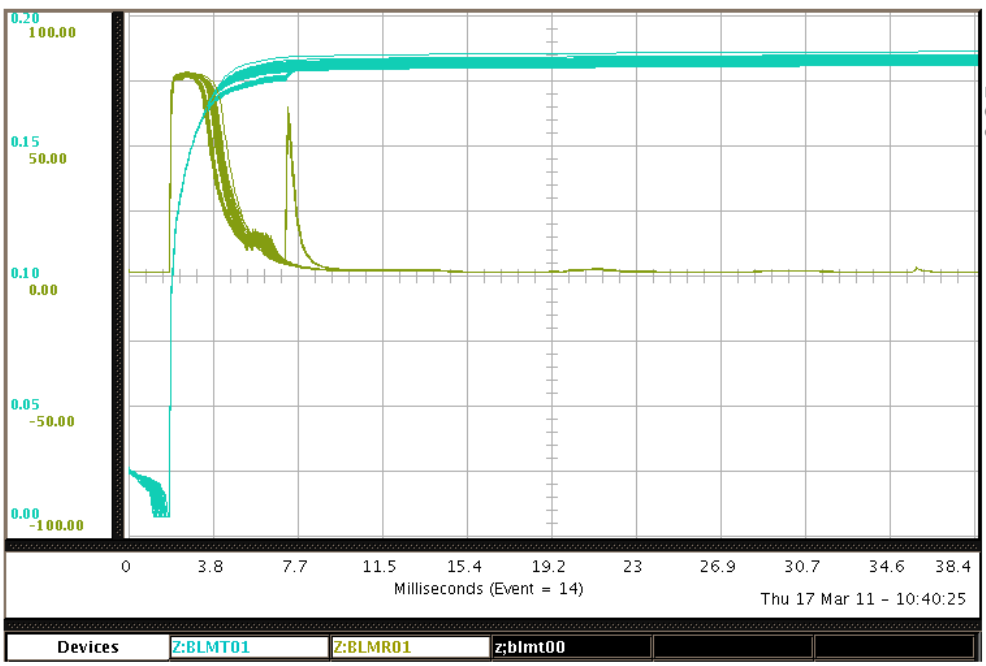
NOTE: There is still an initial overrange condition indicated by the front panel LED.



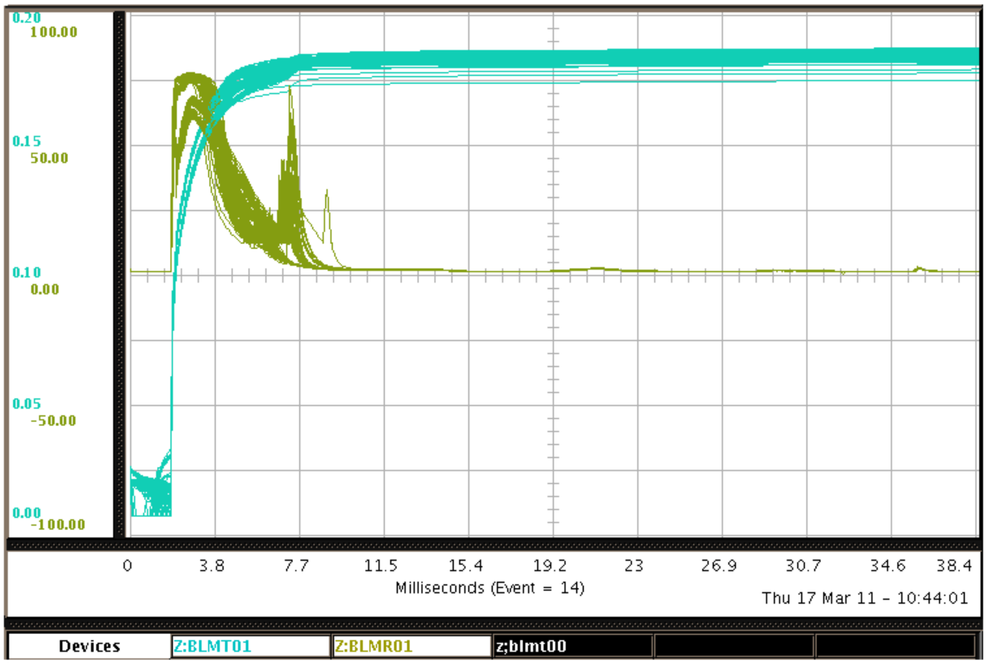
In this Plot the VME channel is still in the High Range Mode, but a series 15k Ohm resistor has been added to the input signal.

The biggest difference with the 15K Ohm resistor is that the initial spike in the signal is slowed enough to avoid causing the channel to go into the overrange mode and the integration results play out in a more linear manner.

You can also see the effect of the resistor comparing the spikes at 7.7 milliseconds on this plot and the previous one without the resistor. You see the peak of the spike come down, but the width increase.



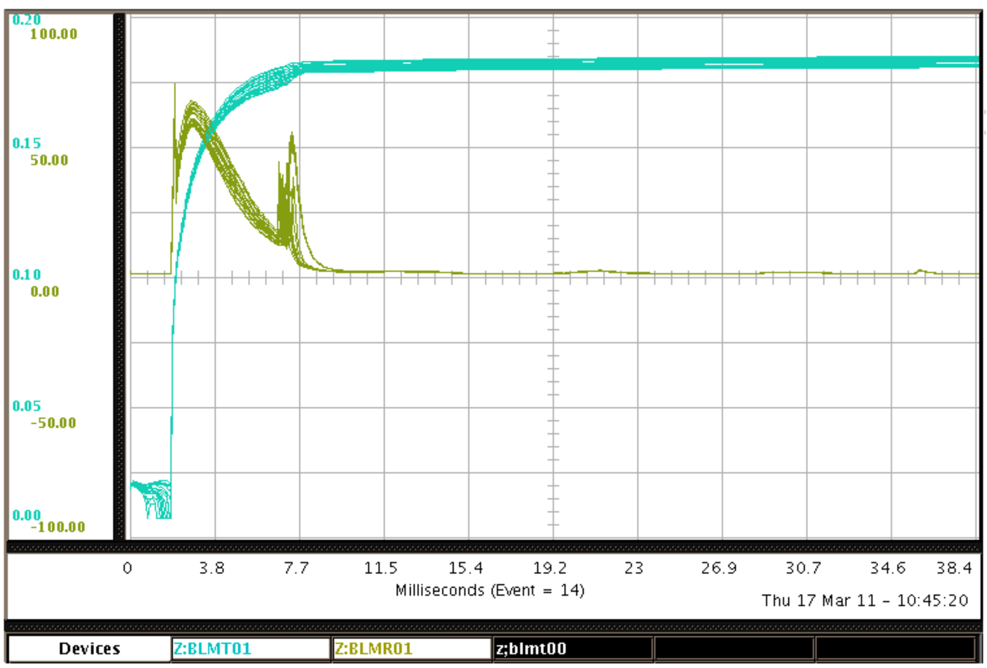
In this plot we have kept the 15k Ohm series resistor, but taken the channel out of High Range mode.



In this plot we have the 15k Ohm series resistor preceding different values of capacitors connected from signal to ground.

The capacitor values were 1000pF, 10,000pF and 47,000pF.

Only the combination of the 15k Ohm and 47,000pF provided enough of a time constant to delay the charge in the initial 80 microsecond integration from triggering an overrange condition in the channel.



In this plot we are solely using the 15k Ohm series resistor and the 47,000pF capacitor to form an RC network on the input signal.

Notice that the initial charge has been spread out over more 80 microsecond integration intervals, but the integrated charge final value is very much unchanged.